CLAIMS

We claim:

1. An apparatus for conducting simultaneous endothermic and exothermic reactions, comprising a bicatalytic reactor cell,
wherein said bicatalytic reactor cell comprises a first reaction channel, a second reaction channel, and a thin metal, heat-conductive separator with first and second catalyst-coated surfaces,
wherein said first reaction channel comprises at least a portion of the first catalyst-coated surface and said second reaction channel comprises at least a portion of the second catalyst-coated surface,
wherein the catalyst on the first catalyst-coated surface comprises an exothermic reaction catalyst and the catalyst on the second catalyst-coated surface comprises an endothermic reaction catalyst,
wherein heat generated by an exothermic reaction catalyzed by said exothermic catalyst on the first catalyst-coated surface is transferred through the thin metal separator to provide heat for an endothermic reaction catalyzed by said endothermic reaction catalyst on the second catalyst-coated surface.

2. An apparatus as in claim 1, wherein said exothermic reaction is combustion and said endothermic reaction is steam reforming.

3. An apparatus as in claim 1, wherein the separator comprises an iron chromium aluminum alloy

4. An apparatus as in claim 1, wherein the separator comprises a nickel chromium aluminum alloy.

5. An apparatus as in claim 1, wherein the thickness of the separator is between about 0.001 and 0.1 inch.

6. An apparatus as in claim 1, wherein the thickness of the separator is between about 0.002 and 0.04 inch.

7. An apparatus as in claim 1, wherein the thickness of the separator is between about 0.002 and 0.02 inch.

8. An apparatus as in claim 1, wherein said catalysts are applied as washcoats to form said first and second catalyst-coated surfaces.

9. An apparatus as in claim 1, wherein at least a portion of the first catalyst-coated surface and at least a portion of the second catalyst-coated surface are directly opposite one another on opposing sides of said separator.

10. An apparatus as in claim 1, further comprising an inlet and an outlet for flow of a reaction stream through each reaction channel, wherein at least a portion of the separator is shaped to form corrugations, said corrugations comprising alternating ridges and grooves.

11. An apparatus as in claim 10, wherein said corrugations form essentially straight channels in the direction of flow of the reaction stream from said inlet to said outlet.

12. An apparatus as in claim 10, wherein said corrugations form a herringbone pattern in the direction of flow of the reaction stream from said inlet to said outlet.

13. An apparatus as in claim 1, comprising a plurality of bicatalytic reactor cells, wherein said bicatalytic reactor cells are arranged in a stack, wherein said stack comprises adjacent, alternating first and second reaction channels, wherein said first reaction channels comprise at least a portion of the first surfaces of two adjacent separators and said second reaction channels comprise at least a portion of the second surfaces of two adjacent separators.

14. An apparatus as in claim 13, wherein the distance between two adjacent separators is between about 0.01 and 0.5 inches.

15. An apparatus as in claim 13, wherein the distance between two adjacent separators is between about 0.02 and 0.25 inches.

16. An apparatus as in claim 13, further comprising a transverse flow plate between each pair of separators, wherein each transverse flow plate comprises a hollow portion in the central portion of the plate to allow flow of a reaction stream through a reaction channel.

17. An apparatus as in claim 16, further comprising a flow redirecting device in the hollow portion of each transverse flow plate.

18. An apparatus as in claim 17, wherein the flow redirecting device comprises at least one grooved plate.